Constructed Wetlands versus Retention Pond BMPs: The Role of Vegetation in Improved Pollutant Management for Urban Stormwater Treatment

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Increased urbanization has resulted in a larger percentage of impervious areas that produce large quantities of stormwater runoff and contribute significant amounts of debris and pollutants (e.g., litter, oils, heavy metals, sediments, nutrients, organic matter, and microorganisms) to receiving waters. Controlling peak flow volumes and removing or buffering the pollutant stressors have become the stated goals of structural stormwater best management practices (BMPs). Two popular structural BMPs are retention ponds and constructed wetlands. While many studies have evaluated the capabilities of retention pond and constructed wetland BMPs to reduce pollutant concentrations and loadings, few have focused on the internal mechanisms relating to the efficacy of these stormwater BMPs. The experimental design of this study incorporates the construction of BMP mesocosms to evaluate, describe, and model key processes that occur within constructed wetland and retention pond-simulated BMPs. The study will occur in three phases that involve the sampling and analysis of (1) sediment parameters, wetland vegetation, and nutrient species; (2) bacterial and pathogenic indicators; and (3) metal species to evaluate and model the interactions, transformations, and long-term pools occurring within these treatment systems. The development of models to predict the mechanisms within constructed wetland and retention pond BMPs will aid in reducing uncertainty and increase the accuracy in predicting the results of BMP implementation projects. Ultimately, the goal is to develop models that provide regions, states, counties, and municipalities with the ability to predict stressor changes for any similarly designed BMP in any site installation based on a range of expected influent concentrations and flow characteristics. Better stormwater BMP design can lead to overall improvements in receiving water quality to meet state and federal water quality standards. The additional benefits of improved water quality include increased consumption of fish and shellfish, increased use of recreational waters, and protection of drinking water sources from potential contaminants.